

C4

— DRIVE STARTUP MANUAL —
KEB-PM

VERSION 5.2



Document History

Date	Version	Summary of Changes
June 28, 2021	5.2	Updated Motor / Encoder wiring
January 13, 2021	5.1	Added Car Stalling troubleshooting procedure
November 2, 2020	5.0	Changed header name from NTS Slowdown to Construction Speed Updated description and procedure to reference the car running in Construction mode
March 12, 2020	4.0	Added LOTO to Construction procedure Added NTS procedure
March 5, 2020	3.0	Updated Construction procedure to include the run box must be set to ON
August 23, 2019	2.0	Changed cover page New document format Added secondary brake wiring
October 23, 2018	1.0	Initial Submittal

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KEB Drive

The KEB drive is a permanent magnet AC drive.



Figure 1: KEB PM Drive

Equipment/Settings Verification

Set and verify the equipment matches the job specific parameters for proper operation. See *C4 Controller sheet 01 Getting Started Parameter Table* for more information.

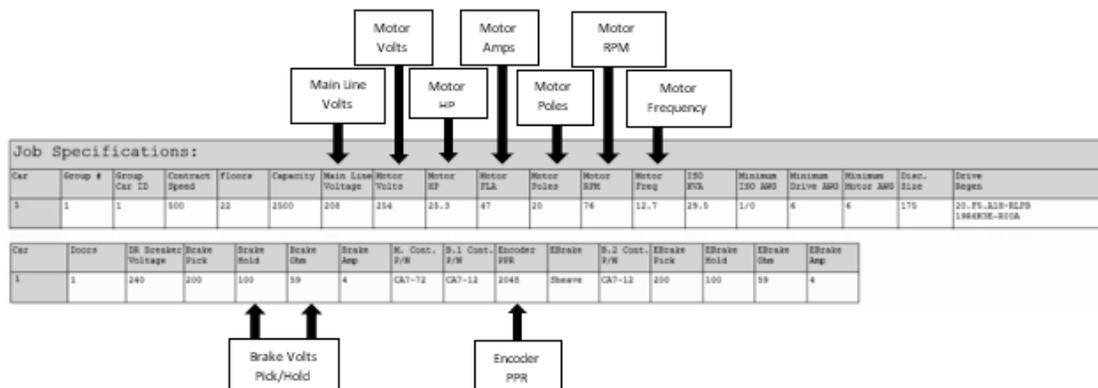


Figure 2: Example of Parameter Table

Scroll through the motor parameters and verify that they are set to the motor nameplate values prior to performing the Motor Learn procedure.

Grounding Requirements

NOTE: A proper and effective building ground connection is required for the safe and successful operation of the controller.

Examples of a proper building-to-controller ground is as follows:

1. Attach the ground wire to the street side of a water main.
2. Attach the ground wire to a grounding rod in the pit.

The controller has a common ground bus terminal connection.



Figure 3: Ground Bus Terminal

- The building, motor, transformer, and filter(s) must all share a common ground. This removes ground loops, limits impedance, and routes noise into the ground.

Wiring

A checklist must be completed during the drive wiring process. See Appendix 1 for terminal location.

Power

Perform the following to connect power. See *C4 Controller sheet 03 Machine Room* for job specific information.

- Connect main line power to terminal blocks L1/L2/L3.
- Connect the ground wire to the yellow/green terminal block next to L1-L3.

Brake

Perform the following to connect the brakes. See *C4 Controller sheet 05 Brakes* for job specific information.

- Connect the main brake wiring to terminal K1 / K2 and the secondary brake wiring (if equipped) to terminals J1 / J2 located on the terminal block next to the M Contactor.

Motor / Encoder

Perform the following to connect the drive to the motor and encoder cable. See *C4 Controller sheet 04 Drive and Motor* for job specific information.

- Connect motor leads to the M contactor at T1/T2/T3.
- Connect the encoder cable to the EnDat card mounted on the drive.

The table below lists the Wiring References for Common Encoders.

Table 1: Wiring References for Common Encoders

Encoder	Heidenhain	Ziehl	Torin ECN413	Hollister Whitney
PWR	Green/Blue and Brown	Gray/Green	Red/Pink	Brown
COM	Green/ White and White	Pink/Yellow	Black and Red/White	White
SIN	Green/ Black	Gray/Pink	Green and Black	Green
/SIN	Blue / Black	Red/ Blue	Yellow and Black	Yellow
COS	Red/Black	Blue	Blue and Black	Blue
/COS	Red/Black (7)	Red	Red and Black	Red
Z				
/Z				
CLK+	Gray	White	Gray	Black
CLK-	Pink	Brown	Silver	Violet

Encoder	Heidenhain	Ziehl	Torin ECN413	Hollister Whitney
DAT+	Violet	Violet	Purple	Gray
DAT-	Yellow	Black	White	Pink
SHIELD	Shield	Shield	Shield	Shield

Construction

All safety inputs are functional during Construction mode on the C4 product. When these safety devices are installed, they are connected per the *C4 Controller sheet 02 Machine Room I/O* of the prints, even if still on Construction mode. The following includes instructions for when none of these devices have been installed prior to beginning on Construction mode.

Perform the following to wire the Construction Box. See the *C4 Controller sheet 01 – Getting Started* for job specific information.

1. Turn off power to the controller.
2. On the MR board, connect a jumper from L120 to terminals LFT, LFM, and LFB.
3. Are there rear doors?
 - a. If there are rear doors, connect L120 to terminals LRT, LRM, and LRB. Go to step 4.
 - b. If there are no rear doors, go to step 4.
4. Connect a jumper from H120 to PIT, BUT, BFL, and TFL.
5. Is a secondary brake present?

NOTE: There will be two Brake boards.

- a. If a secondary Brake board is present, connect a jumper from M120 to SFM. Go to step 6.
- b. If no secondary Brake board is present, go to step 6.

NOTE: Rope gripper contact will make SFM.

6. Is a Run/Stop switch being used?
 - a. If a Run/Stop switch is used, go to step 7.
 - b. If a Run/Stop switch is not used, connect a jumper from H120 to SFH. Go to step 9.
7. Connect a wire from the MR board H120 to one side of the Construction Box Run/Stop switch.
8. Connect a wire from the MR Board SFH to the other side of the Construction Box Run/Stop switch.

NOTE: A closed switch indicates run and an open switch indicates stop.

9. Connect a jumper from 24 VDC to MM.

10. Is the run box being used?
 - a. If the run box is being used, perform the following:
 - Connect the UP button to the input of the CUP
 - Connect the DOWN button to the input of the CDN
 - Connect the Enable to CEN (jump high if not available)
 - Power up the controller by turning on main power, pressing in all push breakers, and turning on the L1/L2 breaker
 - Go to step 11
 - b. If the run box is not being used, power up the controller by turning on main power, pressing in all push breakers, and turning on the L1/L2 breaker. Go to step 12.
11. Press the right button to access the Main Menu and navigate to Setup | Miscellaneous | Enable Const. Box to On. Scroll right and press Save.

NOTE: When the Enable Construction Box is On, the onboard inspection buttons are disabled.
12. Verify the Car Door Bypass and Hoistway Bypass switches are in the OFF position.
13. Place the INSPECTION switch to INSPECTION.
14. Verify the mode of operation is Construction.

Construction Speed

During installation, the Car Top (CT) and Car Operating Panel (COP) are not connected to the controller. The normal terminal stopping (NTS) may cause the car to run slow while moving on Construction mode.

If car runs slower than command speed, perform the following:

1. Turn off power to the controller.
2. Temporarily remove the NTS wire on the MR board.
3. Connect a jumper from NTS input on the drive to REF.
4. Power up the controller.
5. Leave the jumper on while on Construction mode.

When no longer on Construction mode, perform the following:

1. Turn off power to the controller.
2. Remove the jumper from NTS input on the drive to REF.
3. Reconnect the NTS wire to the MR board.
4. Power up the controller.

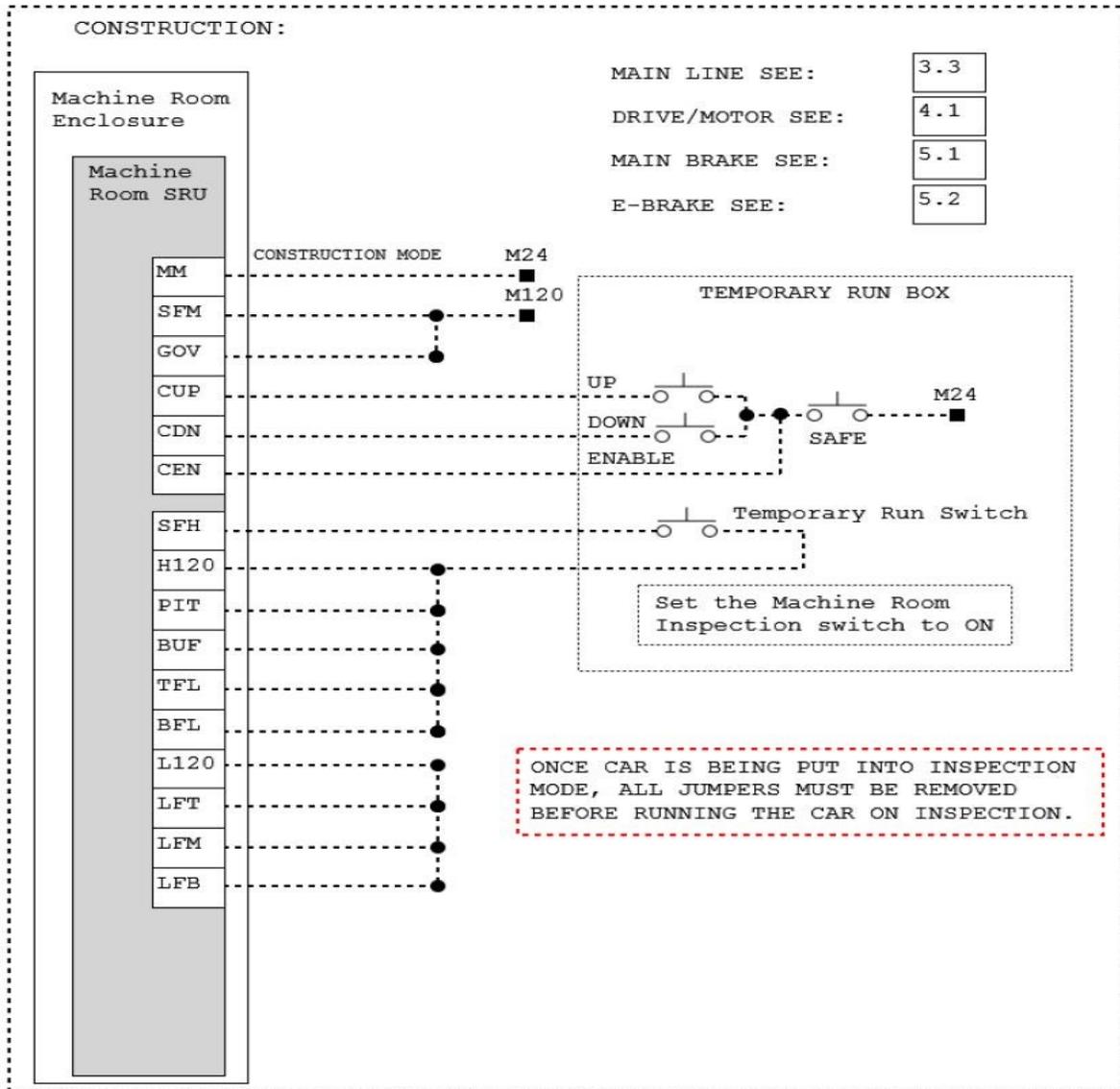


Figure 4: Example of Construction Wiring

Powering Up

Perform the following to power up the drive.

1. Apply external power by closing the main disconnect.
2. Close the two-pole breaker and all pushbutton breakers.
3. Verify the LCD on the Smartrise board and the drive powers up.

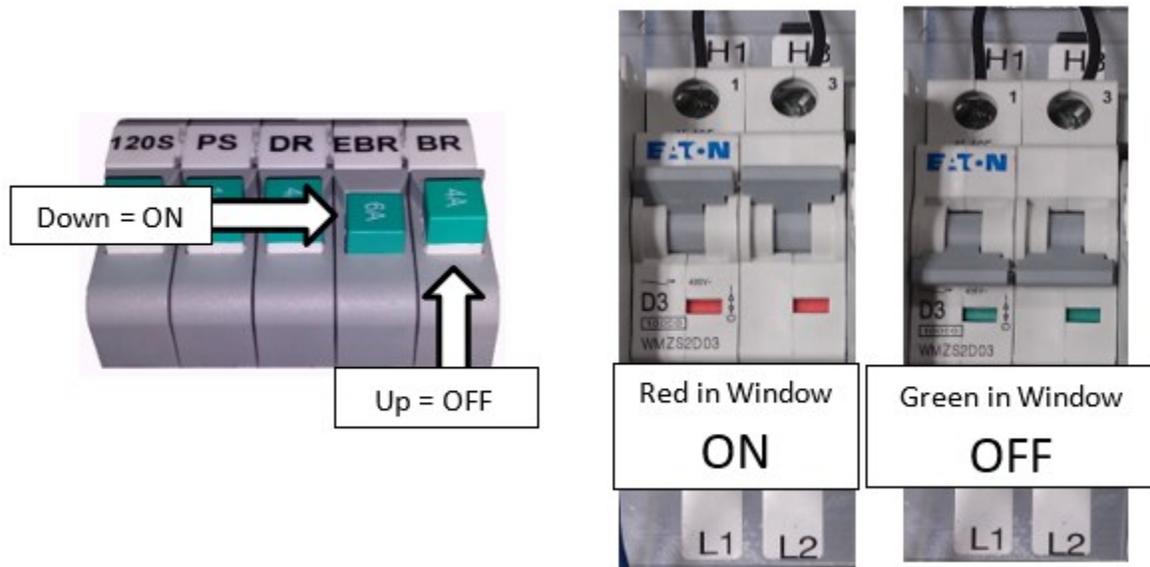


Figure 5: Breakers

Encoder Cable

Proper connection of the encoder cable to the drive is key to a proper running elevator. Many drive issues can be attributed to a defective encoder, encoder cable, or the encoder (or cable) not installed properly.

The cable shall be kept a minimum of 8 inches (20 cm) away from all wires having greater than 24 VDC on them. For best results, run the encoder cable in a separate conduit from the controller to the motor.

It is absolutely necessary to ensure these signals are well shielded! Noise on the analog signals resulting from breaks in the shield or improper shield termination will result in vibration in the motor and poor ride quality.

KEB Motor Learn

Smartrise programs the KEB drive with factory defaults to properly communicate with the controller. After factory testing, customer motor data (from customer's EDF) is programmed into the drive to provide an easier "out of box" installation.

Initial Setup

The complete motor data must be learned with the automated learn function.

The Motor Learn function can be found under the Tune Parameters group from the Programming menu (Home > Prog > Tune Parameters > LL01).

Perform the following for initial setup.

1. Set Motor Tuning LL01 to Start.
2. Follow the instructions on the LCD screen.
 - On the MR board, Toggle DIP 6A (Top bank) to on to begin the tuning process.
 - Once complete, turn off DIP 6A.

The process should take 2-5 minutes and will emit a high-pitched noise while the drive measures various motor parameters.

KEB Encoder Learn

For absolute encoders on PM motors, if at any time the physical relation between the motor shaft and encoder changes (for example, encoder replaced, encoder slippage, etc.) the encoder position must be relearned.

SPI Encoder Learn

SPI can be done with the ropes on and the brake set.

Perform the following to start the SPI functionality.

1. Navigate to LL05 and follow the instructions on the LCD.
2. Set Motor Tuning LL05 to SPI (Start).
3. Follow the instructions on the LCD screen.
4. On the MR board, toggle DIP 6 A (Top bank) to on.
5. Once complete turn off DIP 6A.

During the SPI process, the motor makes a series of chirps and the LCD display shows the encoder position samples. See Encoder Synchronization for more information.

If the Encoder Synchronization process has previously been completed, the user may abort the Encoder Synchronization step without losing the learned Encoder Pole Position.

Encoder Synchronization

The Encoder Synchronization process determines the correct A/B encoder channel phasing and direction of rotation for PM motors and immediately follows either method of learning the encoder pole position.

Perform the following for encoder synchronization.

1. Set Encoder Synchronization LL07 to Start.
2. Follow the directions on the drive keypad.

NOTE: The drive runs the elevator and swaps the phasing and direction of the A/B channels as needed.

Operation

Run the car and complete the checklist during the verification process.

No Faults

Make sure the car is moving without triggering a fault either on the Smartrise SRU Board or the drive. If the SRU Board displays a drive fault, look at the drive to see what the fault is. See Drive Fault / Encoder Fault for troubleshooting drive fault.

Proper Direction

Make sure the car is moving in the same direction as the control switch on the Run Box. See Wrong Direction for troubleshooting proper direction faults.

At Speed

Make sure the car is moving at the proper inspection speed (approximately 50 fpm). See Car Moving to Slow or Rough for troubleshooting at speed faults.

Under Control

Make sure that the car is moving under full control. The car should stop when commanded from the Run Box. Verify that the car runs with no faults for 10 seconds or more. See Brake Not Lifting for troubleshooting under control faults.

Continuous Run

Make sure that the car does not stall when using a geared motor. See Car Stalling for troubleshooting when the car stalls.

Troubleshooting

The following sections list troubleshooting procedures. See Appendix 3 for advanced troubleshooting procedures.

Drive Fault / Encoder Fault

The most common fault at drive startup is the Encoder fault.

Perform the following checks to correct this fault:

- Perform the Encoder Synchronization(LL05).
- Check for a solid shield-to-ground connection at the motor and drive.
- Check for correct colored encoder wires to the terminals.
- Swap the A with A/ phasing by navigating to parameter LE03 and selecting A-B Swapped.
- Perform the SPI Encoder Learn process after swapping any encoder wires or phasing.

Brake Not Lifting

If the brake is not picking, make sure that the brake is wired according to *C4 Controller sheet 05 Brake Connection* and if there is a second brake installed, verify that the EB terminal is jumpered to the terminal. See the *C4 Controller sheet 01 – Getting Started* for more information.

If the brake has the proper voltage check the following:

- During a run command, check the DC voltage between points K1 / K2 and J1 / J2 if secondary brake is installed. Verify the voltages are also at the brake coil(s) when commanded to pick.
- Verify that the actual brake voltage matches the brake coil voltage shown on the *C4 Controller sheet 01 – Getting Started* Parameter table.

Wrong Direction

If the car is moving in the wrong direction check the following:

- On the Smartrise controller board, make sure that IO CUP comes on when commanding the **UP** direction and IO CDN comes on when commanding the **DOWN** direction.
- Swap two of the motor leads (T1 with T2).

Car Moving to Slow or Rough

If the car is moving to slow or rough perform the following:

- Swap the A with /A phasing by navigating to parameter LE03 and selecting A-B Swapped. Run LL05 after swapping the phases.
- Verify the brakes are lifting fully.

Car Stalling

With a geared motor, if your car is on Construction and is stalling after an attempted run perform the following:

- Navigate to MAIN MENU | SETUP | SPEEDS | MIN ACCEL SPEED and increase the parameter from 1 to 5.

Appendix 1 Terminal and Encoder Card Locations

The figures below show the terminal and encoder wire terminal locations.

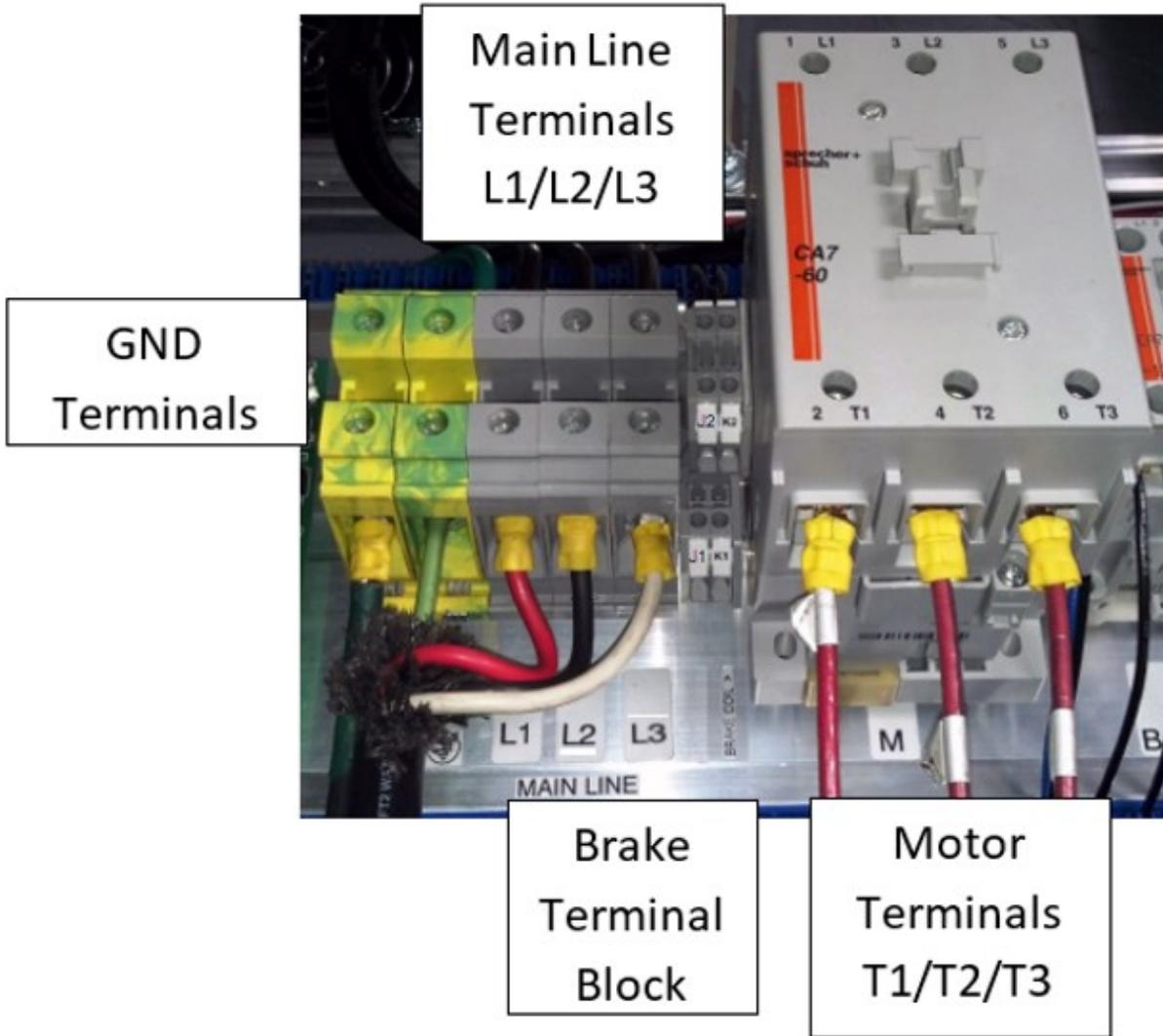


Figure 6: Terminal Locations

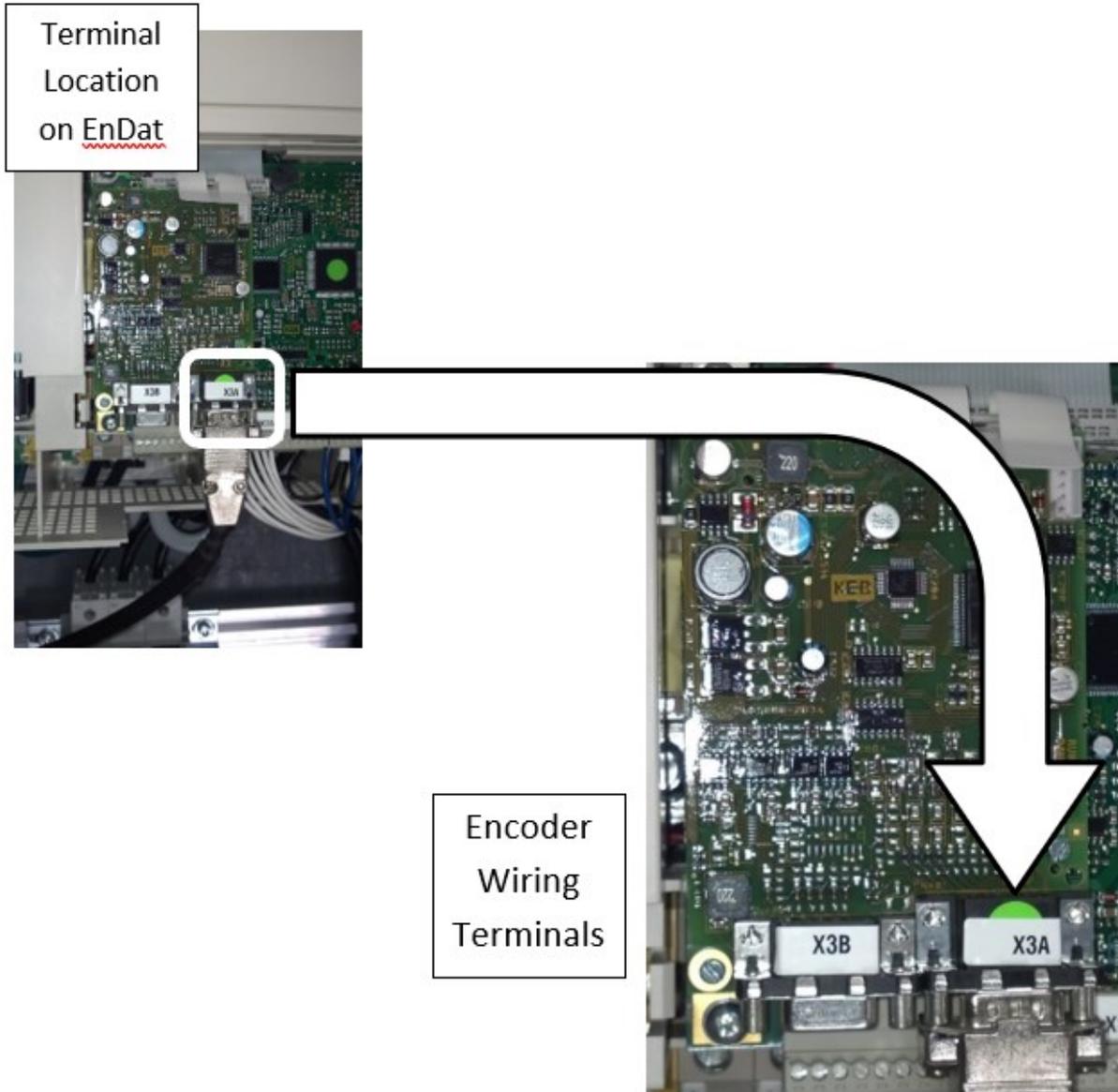


Figure 7: Encoder Terminal Location

Appendix 2 KEB Programming Menu

The programming menu is where all manual parameter adjustments are made and can be accessed at Home > Prog (F3).

The table below lists the Parameter Groups.

Table 2: Parameter Groups

Parameter	Parameter Group	Description
OS00 - OS22	Operator System	Provide general information about the operator and drive hardware and software. Additionally, the operator password level is set here which allows for different access levels.
CH01 - CH03	Configuration Handling	Allows a user to save parameters and default to OEM settings.
US02 - US06	Basic Setup	Provides the very basic information needed to configure the drive, including motor type, control type, and contract speed.
LI01 - LI20	Inputs:	Defines the logic of the inputs and assigns control functionality to the digital inputs.
LM01 - LM33	Motor Data	Defines and displays all relevant motor values and motor protection settings.
LE01 - LE36	Encoder Data	Defines the settings and scalings of the drive encoders.
LN01 - LN05	Machine Data	Defines the machine data, including sheave diameter, roping ratio, and rated load values.
LS01 - LS55	Speed Profile	Adjusts the speed, acceleration, and jerk values across the elevator run profile.
LL01 - LL17	Tune Parameters	Contains the automatic tuning parameters. Here you can program the system inertia, motor data, and motor pole positions.
LC01 - LC44	Control Setting	Contains advanced adjustment parameters which affects the motor gains, system inertia gains, pre-torque, etc.
LT01 - LT13	Timer Parameters	Adjusts brake and drive signalling timers.
LP01 - LP08	Positioning Parameters	Contains the adjustments needed for the drive.
LX01 - LX18	Special Functions	Allows advanced adjustment of the drive and facilitates function tests of drive components.
LA01 - LA40	Analog I/O	Defines and adjusts the analog inputs and outputs.
LO01 - LO20	Outputs	Defines the functionality of the relay and solid-state drive outputs.
FB01 - FB55	Field Bus Configuration	Defines the settings for the control with serial communication.
TS01 - TS08	Terminal Slowdown	Defines the settings for the NTSD inputs and speed thresholds.

Appendix 3 Advanced Troubleshooting

The following list of troubleshooting steps are to help with the startup and smooth running of the drive.

Starting Over (Defaulting Drive)

Sometimes parameters get changed, or certain functions that should work are not working for no apparent reason. In this case, starting over with factory defaults may solve these issues.

Perform the following to default the drive to factory settings.

1. Navigate to US03 and load the opposite configuration of what is shown.
2. To load opposite configuration:
 - a. If the original configuration is Gearless, navigate to PM | Induction | Gearless and load (Induction) Geared and Save. Go to step 3.
 - b. If the original configuration is Geared, navigate to PM | Induction | Geared and load (Induction) Gearless and Save. Go to step 3.
3. After this value is saved, go back and load the correct type. This does a complete background default on the drive.
4. Navigate to US05 and select Write Configuration to Drive.

Perform the following to re-load OEM values (Programmed by Smartrise).

- Go to US05 and select Restore OEM Defaults to reload Smartrise settings.

Vibration

If any vibration occurs:

- Cut the KP (LC03, LC04) and KI (LC08, LC09) gains in half.

Motor Noise

If the motor sounds noisy:

- Change LE.05 to 8 (PM)

Motor Not Running When Given Command

Perform the following when a motor is not running with given command.

1. Check LI.01: Needs to be NPN for the drive to receive signals from controller.
2. Verify parameters LF.41 through LF.43 are set to the correct value See Parameter table on the prints.

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